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Eastern North Pacific Hurricane Season of 1972

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ABSTRACT—The 1972 tropical cyclone season in the eastern North Pacific Ocean is discussed and compared with past hurricane seasons. Pictures from the Advanced Technology Satellite series (ATS 1 and 3) show five storms or developing storms at one time. Storm tracks and a brief discussion of each storm are included.

1. SEASONAL STATISTICS

The 1972 Tropical Cyclone Season in the eastern North Pacific Ocean began on May 31 and continued through November 15. Advisories and bulletins were issued on 18 tropical cyclones during this period. Eight of the cyclones reached hurricane strength and four reached tropical storm intensity. A tabulation of hurricanes and tropical storms by month of beginning for the years 1966–1972 is given in table 1. This 7-yr period is the interval of full operational satellite coverage of the Eastern Pacific. The 1972 total of eight hurricanes is near normal, but four tropical storms is less than experienced in recent years. This may be due, in part, to improved satellite evaluation of storm intensity developed by Dvorak (1972) and to strong support from the 55th Weather Reconnaissance Wing, McClellan Air Force Base, Sacramento, Calif. A number of similar-appearing depressions were undoubtedly upgraded to tropical storm intensity in earlier years when a closer surveillance of the storms was not possible.

The number of advisory days (table 2) is a measure of seasonal acitivity. Days with two storms were counted twice, those with three storms, three times, and so forth. Between May 31 and November 15 there were 116 days with tropical cyclone activity and 75 with tropical storms or hurricanes. Three hundred and thirty-three bulletins or advisories were issued by the Eastern Pacific Hurricane Center (EPHC)—151 were for the tropical storm category and 102 for hurricanes. The greatest activity occurred in August. Figure 1 shows the highest daily wind speed observed in the forecast area for July through early October. From August 6 through September 6, winds were at least of tropical storm intensity somewhere in the forecast area. Twenty-five of those 32 days had winds of hurricane intensity. Those storms that started above the tropical storm classification line (34 kt) on figure 1 developed rapidly from disturbances or depressions. Those curves that end at wind speeds above 33 kt were from storms leaving the forecast area as their tracks crossed 140°W, or moved onshore and dissipated.

2. STORM EFFECTS

No casualties caused directly by hurricane winds or seas were reported. Direct property damage appears to have been light. Only two storms were tracked into Mexico. Hurricane Annette, which crossed the coast southeast of Manzanillo, caused no damage but brought several days of rainy weather. Hurricane Joanne moved across Lower California near Laguna Chapala and then to the mainland near Puerto Peñasco, Mexico, causing considerable local flooding in northern Baja California, Sonora, and Arizona.

Considerable concern for Southern California beach areas was generated by hurricane Gwen. High seas and surf and a storm tide were forecast. The seas and surf verified, but the storm tide did not. Hurricane Hyacinth moved into Southern California on September 6 but had all but dissipated prior to reaching the coast.

A number of vessels altered their courses to elude storms. Near the Mexican coast, where shipping is the heaviest, less freedom of movement is available and speed changes were used in an attempt to evade storms.

Fifty to 60 fishing craft in a 300-n.mi. long lane at 10° N from 127° W westward were threatened by Joanne before she altered her course northwestward and northward October 3. The vessels were north of a very active intertropical convergence zone (ITCZ) and west of the hurricane, which was moving a little faster than the vessels' capability to outrun her. They elected to enter the ITCZ rather than risk the storm. As the storm moved northwestward, the ITCZ weakened, ending the threat.

One vessel, the *Regina Maris*—a 117-ft, three-masted, square-rigged sailing vessel—with 53 persons on board, was damaged and needed assistance as a result of Celeste. Reconnaissance aircraft found the vessel some distance from its estimated position and guided a rescue aircraft with gasoline, pumps, and supplies to the distressed ship. The reconnaissance aircraft then continued on its mission to Celeste.

3. BASIC DATA

Satellite coverage of the storm area was superior to that of previous years. Automatic picture transmission (APT) from ESSA 8 gave a morning picture of the storm area and that from ESSA 9 gave an afternoon picture. The latter was not received locally until the facsimile trans-

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TABLE 1.—*Tabulation of hurricanes (Hu) and tropical storms (TS) in the eastern Pacific by month and year in which they began*

Year	May		June		July		Aug.		Sept.		Oct.		Nov.		Totals		
	Hu	TS	Hu	TS	Hu	TS	Hu	TS	Hu	TS	Hu	TS	Hu	TS	Hu	TS	Combined
1966			1				4		2	4		2			7	6	13
1967			1	2		4	2	2	1	2	2	1			6	11	17
1968				1		4	3	5	2	1	1	2			6	13	19
1969					1	2	1	1	1	3	1				4	6	10
1970	1			3	1	5	1	3		1	1	1		1	4	14	18
1971	1		1		5	2	2	2	2		1	1		1	12	6	18
1972	1					1	6		1	1		1		1	8	4	12
7-yr total	3		3	6	7	18	19	13	9	12	6	7		3	47	60	107
Annual averages															6.7	8.6	15.3

TABLE 2.—*Monthly distribution of tropical storm and hurricane days* in the eastern Pacific during 1972*

Designation	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
Hurricane	0	2	0	23	3	5	0	33
Tropical storm	1	5	3	19	9	3	2	42
Total	1	7	3	42	12	8	2	75

*Each day with two or more storms is counted by the number of storms; each day is counted according to the highest intensity of the storm.

mission in the late afternoon. Real-time Applications Technology Satellite (ATS 1 and 3) pictures became available routinely through the National Environmental Satellite Service (NESS) after August 2. ATS 1 stopped operating on October 17, after most of the season activity was over. Two exposures were made at roughly 20-min intervals at about 1500 GMT from ATS 3 and two from ATS 1 at about 2200 GMT (0800 and 1500 PDT, respectively. Because of limitations in receiving signals from the satellites, only one could be interrogated at a time. The ATS 1 pictures covered the western part of the area (fig. 2A) and ATS 3 the eastern part (fig. 2B) in excellent detail. The most spectacular ATS 1 picture was taken on August 18 (fig. 2A) showing three existing storms (Celeste, Diana, and Estelle) and tropical depression Fernanda developing on the horizon. Storm intensity was estimated by the Timchalk et al. (1965) method, and by the Dvorak (1972) method. NESS meteorologists alerted the EPHC to suspected areas of development and provided estimates of intensities of existing storms. NESS also advised EPHC by telephone of changes in storm intensity as indicated by ESSA 9 prior to receipt of the facsimile presentation at EPHC.

Forty-six reconnaissance flights were flown by the 55th Weather Reconnaissance Wing with an average of 15 observations per flight. The flights usually reported the center position after traversing the eye in several directions when aircraft capability permitted. Flights remaining overnight at Acapulco, Mexico, or Honolulu allowed extended-range observations of Celeste, Diana, and Fernanda. This is the second year that California-based aircraft have flown to Acapulco via a storm one day and back to the home base via the storm the next day. Since the aircraft were able to remain in the storm area for longer periods of time on these particular flights, the direction and speed of movement were observed and reported in Fernanda, Gwen, and Hyacinth. This added capability became increasingly important as Gwen and Hyacinth moved into northern waters and threatened southern California.

Few surface observations were received from ships near storms. The highest measured wind speed reported by a surface vessel during the season was 60 kt off Cedros Island in Joanne. Estimates of winds of 80–90 kt were received from a fishing vessel during the early stages of Celeste. The strongest wind estimate from reconnaissance aircraft was 125 kt in Gwen on August 26. Maximum wind, minimum pressure, and other characteristics of the individual storms are summarized in table 3, and the storm tracks for the season are shown in figure 3.

4. CHRONICLE OF HURRICANES AND TROPICAL STORMS

Hurricane Annette, May 31–June 7

A tropical disturbance appeared for several days in the intertropical convergence zone prior to May 31. The veteran tropical storm reporter, *Inger*, passed to the northeast of an area of squally weather and veering winds during the early morning hours of the 31st. The disturbance reached storm intensity on the 31st when the *World Nautilus* reported 35-kt winds, also indicating 2- to 3-n.mi. visibility in rain and 12- to 15-ft seas.

Ship routing apparently vacated the storm area and few surface reports were received, although peripheral reports from several ships helped locate the storm near 13°N, 107°W from May 31 through June 3.

U.S. Air Force reconnaissance and satellite pictures indicated that the storm drifted slowly northward, developing hurricane intensity on the 4th (fig. 4), weakening and accelerating north and northeastward after the 5th. On the 6th, it reached a point 300 n.mi. southwest of Manzanillo, Mexico, and reached the coast about 60 n.mi. southeast of Manzanillo about 1800 GMT on the 7th.

No damage to shipping or cargo have been reported

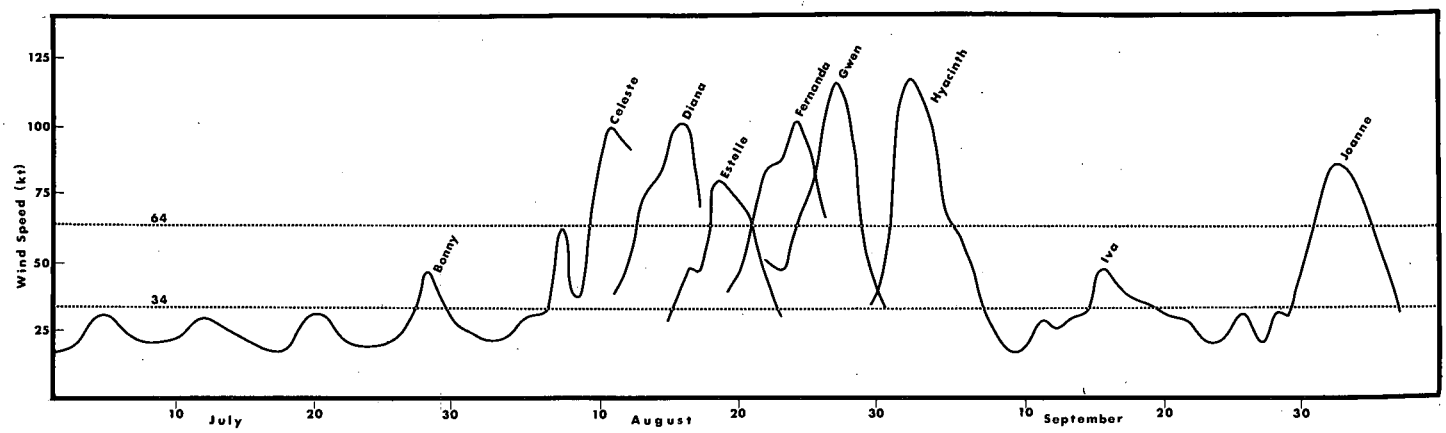

FIGURE 1.—Highest daily wind speed (kt) and storm wind speeds observed in the forecast area from July 1 to Oct. 10, 1972.

TABLE 3.—*Summary of eastern North Pacific tropical cyclones in 1972*

Name	Date	Origin	Dissipated	Highest reported wind speed	Estimated maximum wind speed	Lowest reported pressure	Affected coast/land	Remarks
Hurricane Annette	May 31–June 7	12.5°N 107.5°W	18.3°N 103.5°W	40 kt "SHIP" 15.2°N, 105.0°W 06/1800 GMT	67 kt 03/2127 GMT satellite	993 mb 06/1805 GMT recon	Manzanillo	No damage or property loss reported.
Tropical Storm Bonny	July 27–30	19.0°N 109.5°W.	22.5°N 118.0°W	20 kt	45 kt 28/1800 GMT recon	996 mb 30/1800 GMT recon	None	None.
Hurricane Celeste	Aug. 6–22	14.0°N 120.5°W	22.0°N 173.0°W	55 kt WJZB (See text)	90 kt recon west of 140°W 100 kt at times 14th–20th	966 mb 11/2110 GMT recon.	Johnston Island	Square-rigged ship damaged, required aid, two injured.
Hurricane Diana	Aug. 10–20	9.0°N 114.0°W	21.0°N 157.0°W	50 kt NDIT 13/1800 GMT	74 kt 12/2353 GMT recon 13.8°N, 124.9°W 95–100 kt by satellite	968 mb recon 15/1810 GMT 17.5°N., 130.9°W	Hawaii, Maui. Other islands unknown.	Hampered the rescue of *Regina Maris*.
Hurricane Estelle	Aug. 15–23	9.5°N 111.0°W	27.0°N 136.0°W	35 kt LIJK 17/1800 GMT	75 kt satellite	1004 mb ELEC 19/0000 GMT 21.0°N, 119.8° W	None	None.
Hurricane Fernanda	Aug. 19–Sept. 1	11.0°N 104.0°W.	25.6°N 156.3°W.	55 kt 6ZTU 25/0000 GMT	100 kt 23/1835 GMT recon	953 mb DEDR 17.1°N, 124.1°W 24/0000 GMT	None	None.
Hurricane Gwen	Aug. 21–31	9.6°N 96.4°W	29.5°N 121.5°W	35 kt 29/0600 GMT; VRAW 29/0000 GMT; JPIS 28/1800 GMT; HOTB 28/0000 GMT; PIOA 26/1800 GMT; 6ZTU 23/0000 GMT; MHHB 22/0000 GMT; MHHB	125 kt 26/1800 GMT recon 18.3°N, 109.2°W	941 mb 26/1800 GMT recon 18.3°N, 109.2° W 1002.1 mb PIOA 20.0°N, 115.5°W 28/0300 GMT	None	Passed over Socorro Island night of the 26th.
Hurricane Hyacinth	Aug. 28–Sept. 6	11°N 94°W	23°N 118°W	45 kt GWLA 22°N, 120°W 03/0000 GMT	110 kt recon 31/1712 GMT 11°N, 111°W	1003.2 mb GWLA 03/0000 GMT 22°N, 120°W 962 mb recon 19.1°N, 119.9°W	Clarion Island 75 mi north of center at 01/0100 GMT	None.
Tropical Storm Iva	Sept. 18–22	12°N 102°W	17°N 128°W	40 kt JRZR 18.5°N, 122.5°W 21/0000 GMT	40 kt recon 18/1800 GMT 18.3°N, 110.0°W	999.0 mb recon 16/1800 GMT 17.5°N, 108.2°W 1007.0 mb JRZR 21/0000 GMT 18.5°N, 122.5°W	None	None.
Hurricane Joanne	Sept. 30–Oct. 6	12°N 105°W	31°N 113°W	60 kt POLARIS SEAL 06/0830 GMT 28.0°N, 115.7°W	80 kt recon 03/1750 GMT 18.9°N, 116.5°W	971 mb recon 03/1750 GMT 18.9°N, 116.5°W 982 mb POLARIS SEAL 06/0830 GMT 28.0°N, 115.7°W	Crossed Baja, Calif., on NE heading thru 29°N, 115°W early on 6th. Moved over Point Peñasco about noon with maximum winds reported 45 kt. Locally heavy rain over area night of 5th through 6th.	None.
Tropical Storm Kathleen	Oct. 17–19	15.5°N 109.5°W	21.0°N 108.0°W		40 kt Satellite 18/0300 GMT		None	None.
Tropical Storm Liza	Nov. 14–16	11.0°N 97.0°W	10.8°N 104.7°W	25 kt VPID 14/0300 GMT	50 kt Satellite 14/2100 GMT	1007.2 mb GYDW 14/1200 GMT	None	None.

due to the storm, and no accounts of property damage have been received in the Manzanillo area from several days of rainy weather.

Tropical Storm Bonny, July 27–30

Cloudiness south of Manzanillo began consolidating into a vortex pattern on July 26, moving west-northwest

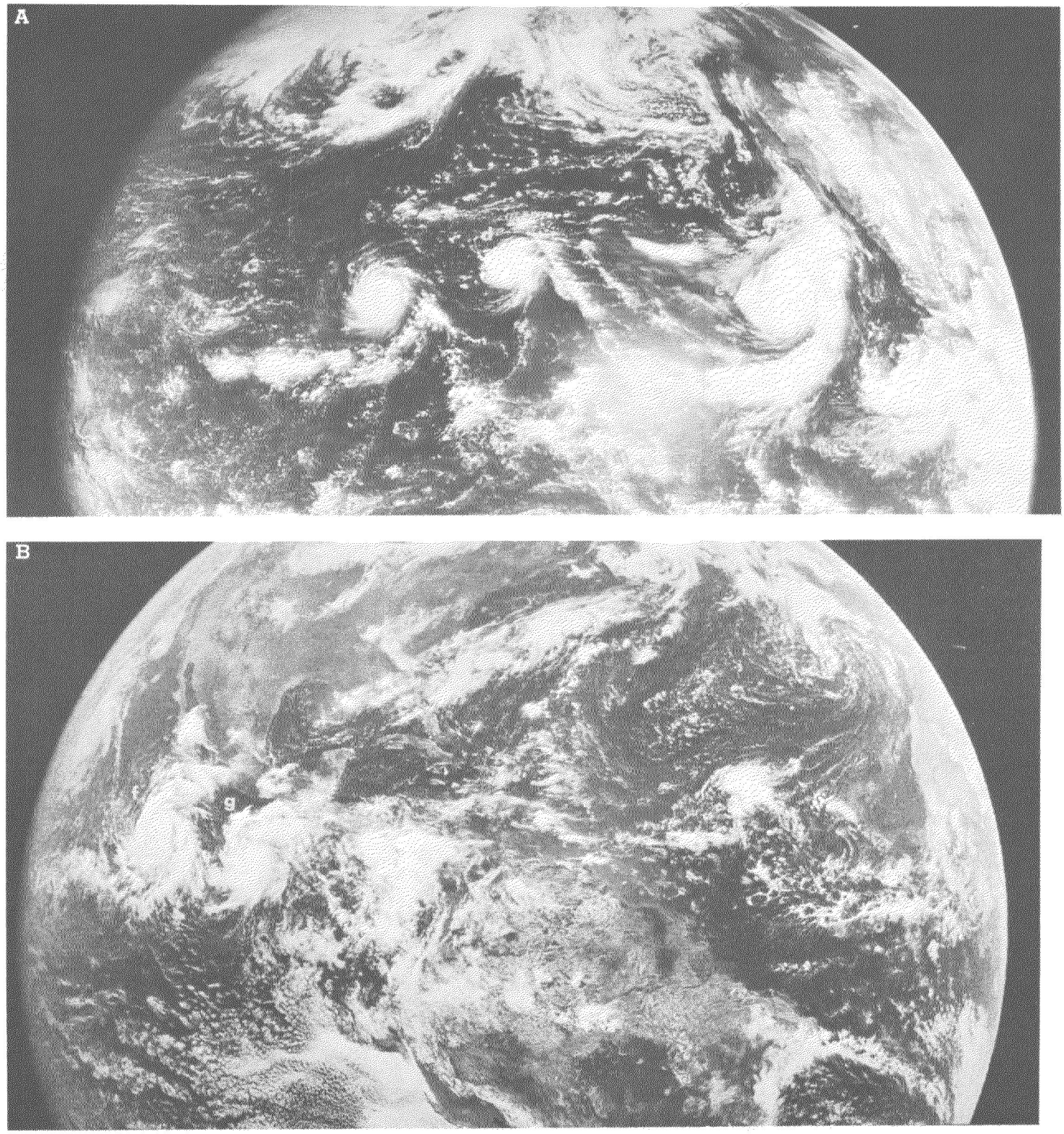

FIGURE 2.—(A) ATS 1 photograph on Aug. 18, 1972, showing hurricanes Celeste (c) and Diana (d), tropical storm Estelle (e), and a tropical depression that was named Fernanda (f) the following day, and (B) ATS 3 photograph on Aug. 21, 1972, showing tropical storm Fernanda (f) and tropical depression Gwen (g).

about 15 kt. Pressures began to fall off the Mexican coast and a tropical depression organized about 300 n.mi. west of Manzanillo on the 27th.

Numerous ship reports indicated the closed circulation. However, all reported winds were more than 100 n.mi. from the center, and none were over 20 kt.

Satellite pictures and sea temperatures indicated further development likely, and a tropical storm advisory was issued for a center near 19°N, 109°W on the 27th. Bonny continued on a west-northwesterly course and was found by reconnaissance aircraft about 300 n.mi. southwest of La Paz at 1800 GMT on the 28th. Figure 5 is a

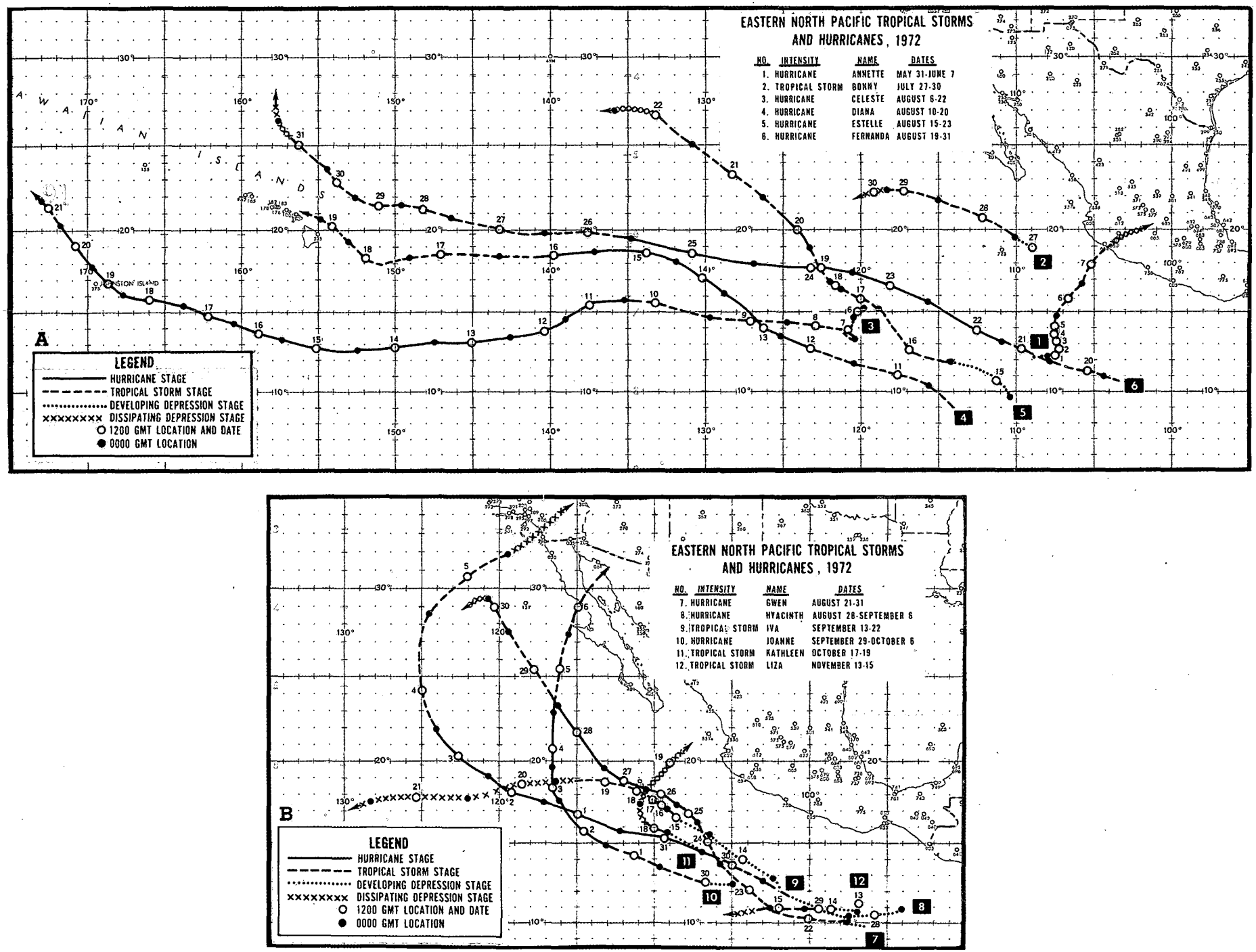

FIGURE 3.—Eastern North Pacific tropical storms during (A) May–August and (B) August–November 1972.

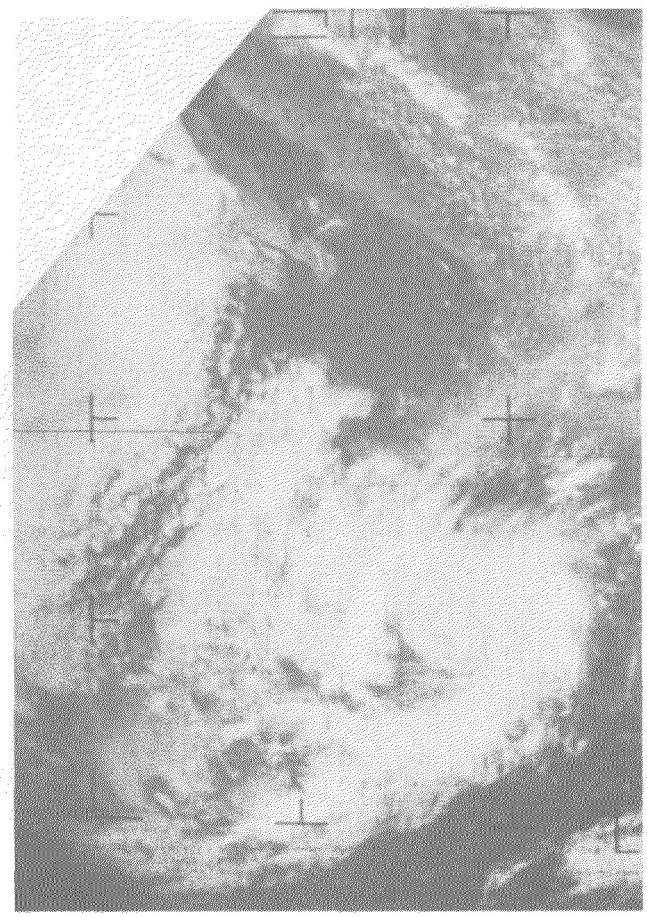

FIGURE 4.—ESSA 8 picture of hurricane Annette with 75-kt winds at 1712 GMT on June 4, 1972.

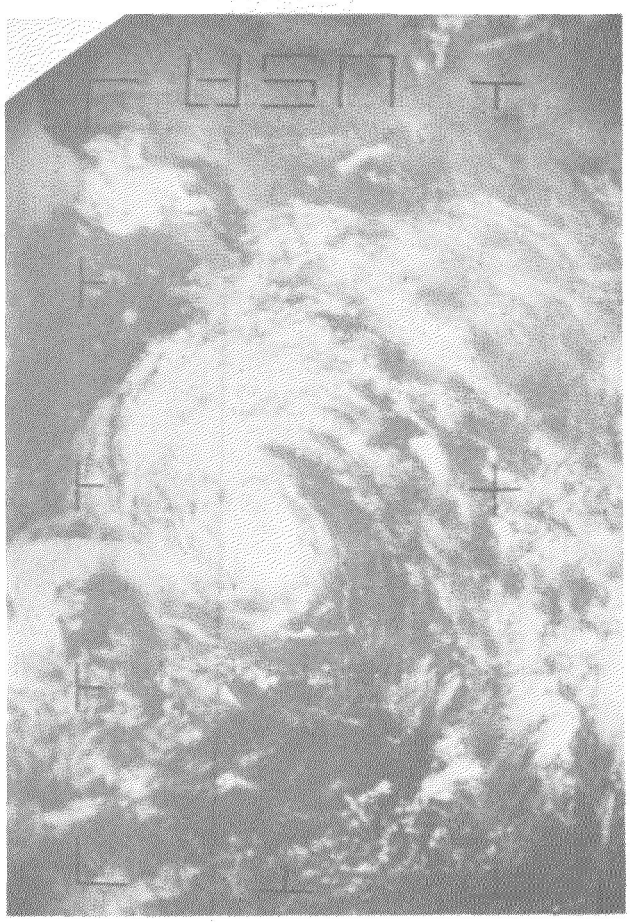

FIGURE 5.—ESSA 8 picture of tropical storm Bonny at 1720 GMT on July 28, 1972. Air Force reconnaissance estimated 45-kt winds at picture time.

satellite picture taken at approximately the same time. Ship reports thinned, but the highest wind speed of 45 kt was estimated by the aircraft crew. The lowest sea-level pressure of 933 mb was measured by a radiosonde unit dropped from the aircraft into the middle of the storm.

Bonny continued west-northwest, moving over cooler water, and began weakening. By late on the 30th, it had become a depression 550 n.mi. south of San Diego, Calif. The cloud pattern persisted and moved westward for several days, but shipboard reports indicated nearly normal trade-wind conditions under the cloudiness.

Hurricane Celeste, August 4–12

A tropical disturbance about 450 n.mi. south of La Paz on August 2 moved westward and stalled near 15°N, 120°W on August 4. It developed slowly into a tropical storm by the 6th, near 15°N, 120°W, then moved slowly westward. No ships reported in the area until 0000 GMT on the 7th when a vessel about 90 n.mi. south of the center indicated westerly winds of 20 kt and a pressure of 1006.4 mb. The *Star Track* estimated winds of 80–90-kt near 16°N, 123°W at 0054 GMT on the 9th. During this rapid development, the *Regina Maris* became involved in the storm and was damaged by high winds and rough seas. It began taking on water at a rate of 2,000 gal/hr and issued a distress call. Two injured persons were treated on board.

The U.S. Air Force reconnaissance aircraft on a mission to observe the hurricane was alerted to the distressed vessel, found it some distance from its estimated position, and guided a rescue aircraft to the *Regina Maris*. The rescue aircraft dropped pumps, gasoline, and supplies to the damaged vessel while the reconnaissance aircraft continued on its mission. The *Vishea Trith* reached the sailing vessel and took it in tow.

CELESTE left the San Francisco area of responsibility on the 12th but continued westward at hurricane intensity to near 15°N, 164°W on the 18th, where it turned northwestward, began weakening, and dissipated near 22°N, 173°W late on the 21st.

The hurricane passed within 30 n.mi. of Johnston Island on the 19th. Personnel on the island were evaculated prior to its arrival. Strongest winds estimated by reconnaissance aircraft were 90 kt at 2110 GMT on the 11th while the hurricane was in the San Francisco area of responsibility and 100 kt at various times and places from the 14th through the 20th while in the Honolulu area west of 140°W

Hurricane Diana, August 10–20

Diana began developing in the wake of Celeste on August 8. A circulation was first indicated in satellite

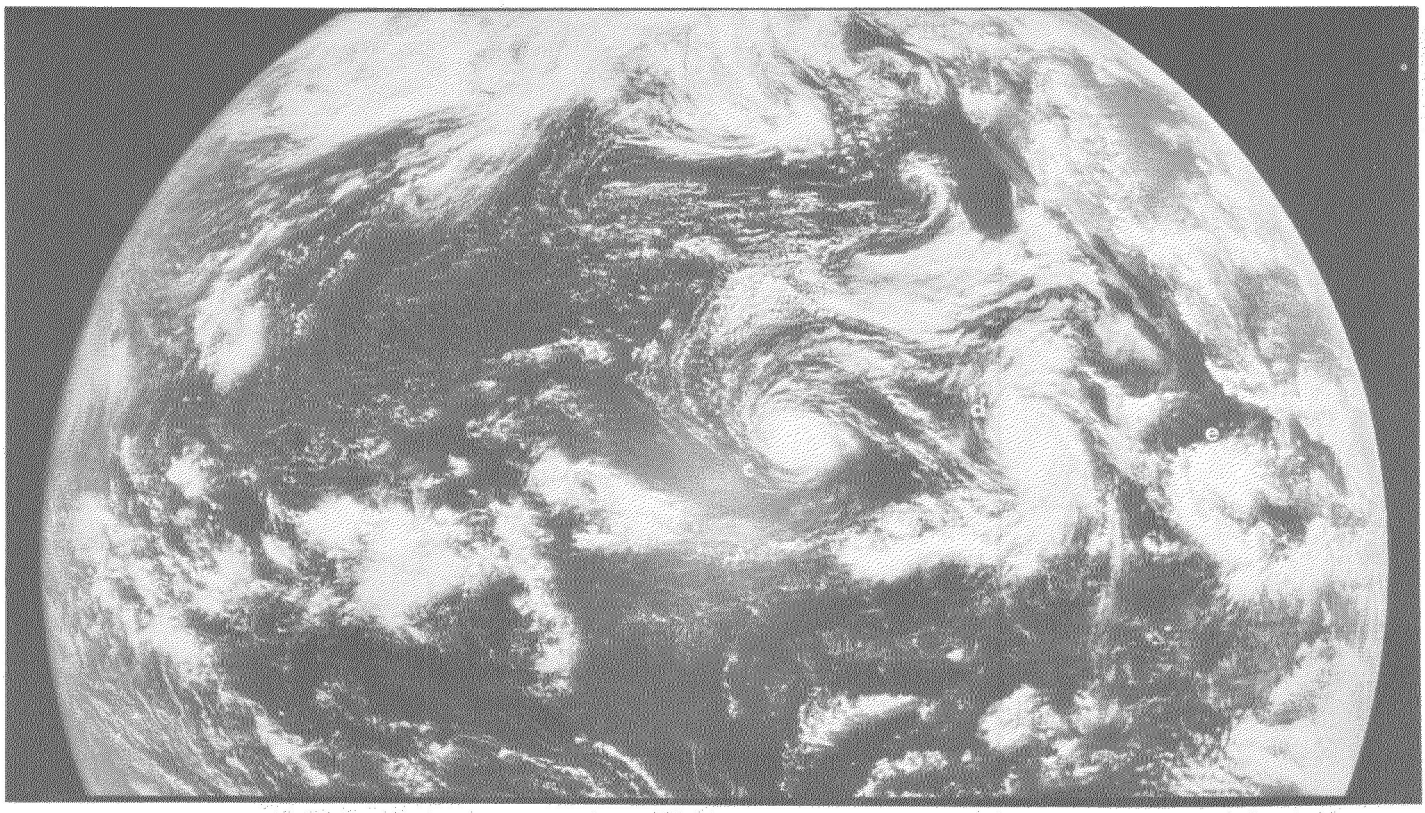

FIGURE 6.—ATS 1 photograph on Aug. 12, 1972, showing hurricanes Celeste (c) and Diana (d) and the developing circulation that subsequently became hurricane Estelle (e).

pictures at 1800 GMT on the 10th near 9°N, 114°W. Squalls and showers extended out 300 n.mi. from the center. Several ships reported winds of 20 kt or less 200–500 n.mi. from the center. The storm increased to hurricane intensity on the night of the 12th near 13°N, 124°W (fig. 6).

The SS *Vishea Trith* (VWWT), towing the disabled *Regina Maris*, headed northeast ahead of the storm in 30- to 40-kt winds to rendezvous with the U.S.C.G.C. *Mellon* near 17°N, 126°W on the night of the 12th; the hurricane was about 120 n. mi. to the south. The tow was transferred in strong winds and high seas, and the *Mellon*, bucking winds of 35–50 kt, headed northeast and east, away from the storm.

The hurricane moved northwestward at 12 kt to 18°N, 131°W on the 14th and then more westerly to 18°N, 150°W on the night of the 17th, weakening to tropical storm intensity. The storm then moved northwestward again where it broke up near Hawaii and Maui during the night of the 19th.

Ships most adversely affected by the storm were the *Vishea Trith*, while aiding the *Regina Maris*, and the *Mellon*. No reports of other damage or injuries have been received as a result of Diana.

Aircraft operations were also affected by Diana. On the night of the 13th, an Air France aircraft, on a flight from Los Angeles to Tahiti, encountered part of the storm at 18°N, 129°W and diverted to the east of its normal flight path.

Hurricane Estelle, August 15–23

After Celeste and Diana moved slowly into higher latitudes, squalls and thunderstorms continued along the ITCZ. On August 12, satellite pictures showed signs of another circulation developing near 12°N, 107°W, in the vicinity of Clipperton Island (fig. 6). By early morning on the 15th, a depression was located 650 n.mi. southwest of Manzanillo moving west at 8–10 kt.

Satellite pictures taken on the 15th indicated continued organization and intensification of the depression and late afternoon pictures suggested that the system had become a tropical storm moving northwest at 12 kt with maximum winds of 40 kt near the center.

The deepening of the storm was accompanied by a slower northwestward movement. The only reported gale wind of the storm was given by the *Columbia* about 150 n.mi. from the center at 1800 GMT on the 17th. Gradual intensification to hurricane strength continued. By late on the 19th, winds were estimated at 75 kt; the hurricane continued northwest at 8–10 kt, weakened, and was downgraded to a tropical storm late on the 20th about 1300 n.mi. west of Puerto Vallarta, Mexico. Estelle continued on a northwesterly course at 10 to 12 kt until the morning of the 22d when the circulation weakened to maximum winds of 30 kt. She then entered more westerly flow around the equatorial side of the Pacific high-pressure area and dissipated near 27°N, 137°W on the 23d.

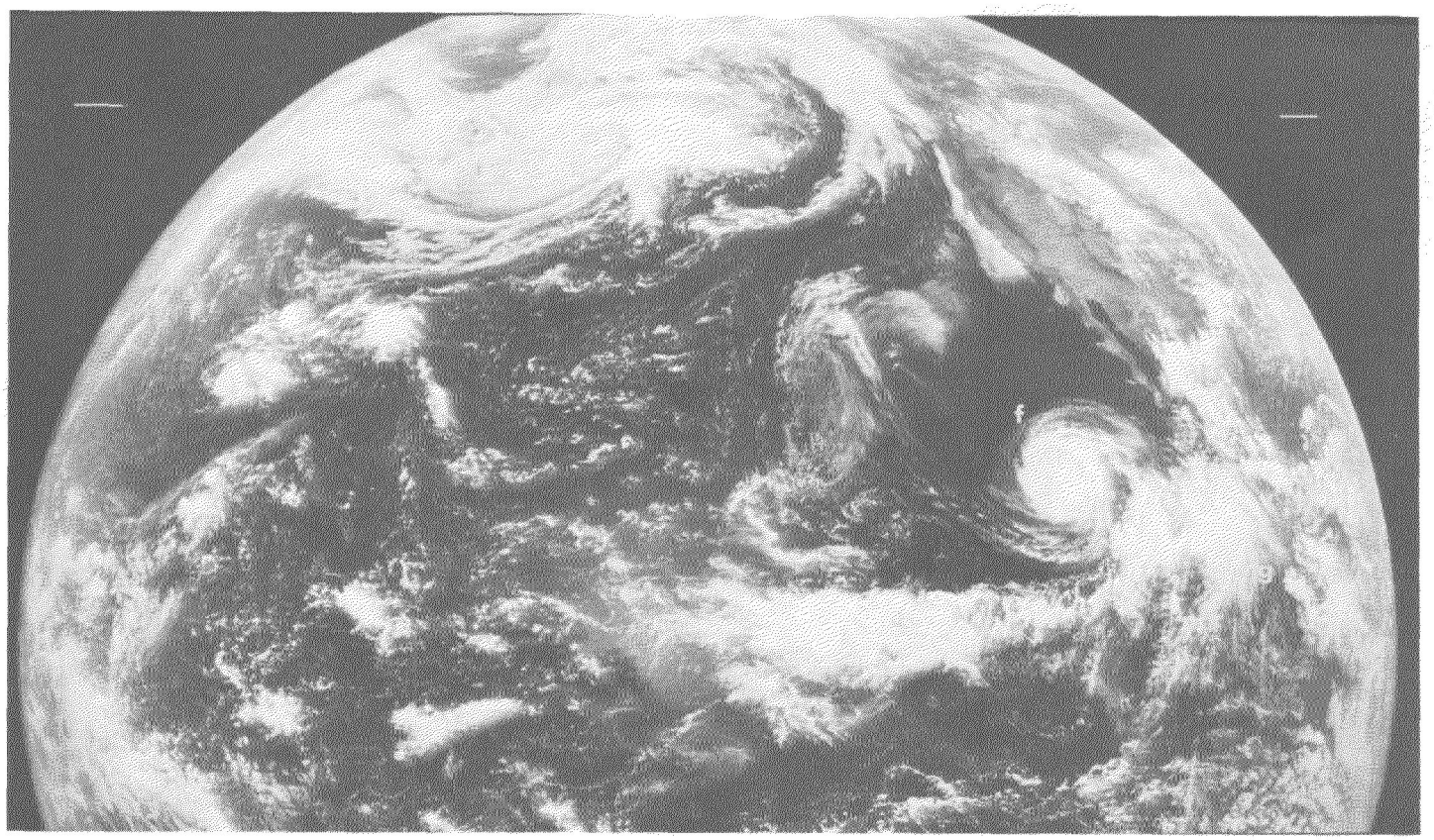

FIGURE 7.—ATS 1 photograph on Aug. 23, 1972, showing hurricane Fernanda (f) 600 n.mi. southwest of La Paz, and tropical storm Gwen (g) 350 n.mi. south of Manzanillo, Mexico.

Hurricane Fernanda, August 19–September 1

An area of cloudiness about 500 n.mi. south of Manzanillo on August 18 developed rapidly into a tropical storm on the 19th. The *Fernfield*, 200 n.mi. east of the center, reported a 25-kt wind from the south, but the long swells reported were also from the south, indicating recent development of the Low. As the ship sailed northwest, she encountered heavy rains as the wind backed to southeast. At 1800 GMT on the 21st, a second ship, 180 n.mi. northeast of the storm center, reported winds increasing to 40 kt. Fernanda continued to intensify, becoming a hurricane late on the 21st. However, a ship passing within 150 n.mi. of Fernanda as the storm intensified to hurricane force reported only 20-kt winds at 0000 GMT on the 22d. Fernanda continued as a hurricane on a west-northwest course, developing 90-kt winds late on the 23d (fig. 7) and 100-kt winds that night. Maximum wind reports from ships 180–200 n.mi. from the storm center between August 23 and 25 were 35–45 kt.

Fernanda was downgraded to a tropical storm on the morning of the 26th and was located near 20°N, 140°W on the afternoon of the 27th. She then moved west-northwest, passing 150 n.mi. north of the main Hawaiian Islands, Hawaii on the 30th and Kauai on September 1. She continued to weaken and was last seen on the weather maps near 31°N, 157°W, on September 3.

Hurricane Gwen, August 21–31

A tropical disturbance near 9°N, 90°W at 1800 GMT on August 20 moved westward to 400 n.mi. east-southeast of Acapulco, Mexico, and developed to tropical storm intensity during the night of the 21st. Two ships reported 40-kt winds and a third, the *Rice Queen*, located about 75 n.mi. offshore near Pt. San Telmo, Mexico, reported 35-kt winds as the storm passed to the south.

On the 22d, the course of the storm changed to northwest and the speed increased to about 15 kt. The strongest winds increased slowly to hurricane intensity and on the 24th, the storm was located by satellite pictures near 15°N, 107°W. The hurricane continued northwest, tracked by reconnaissance aircraft and satellite, reaching its greatest intensity on the 26th, 100 n.mi. southeast of Socorro Island with estimated winds of 125 kt near the center (fig. 8). The hurricane passed over Socorro Island during the night of the 26th, a small but intense storm.

Late on the 29th, the hurricane decreased to tropical storm intensity near 25°N, 117°W. It continued northwest, weakening further and becoming a tropical depression about 250 n.mi. southwest of San Diego, where it dissipated late on the 30th. Weak surface-level low pressure continued in the general area through September 1.

Hurricane Hyacinth, August 28–September 6

A weak circulation was indicated 300 n.mi. south of the Gulf of Tehuantepec in satellite pictures on August 27, and a tropical disturbance bulletin followed reports of disturbed conditions by several ships in the area. The disturbance maintained its intensity and moved westward through 1800 GMT on the 29th, then developed into a

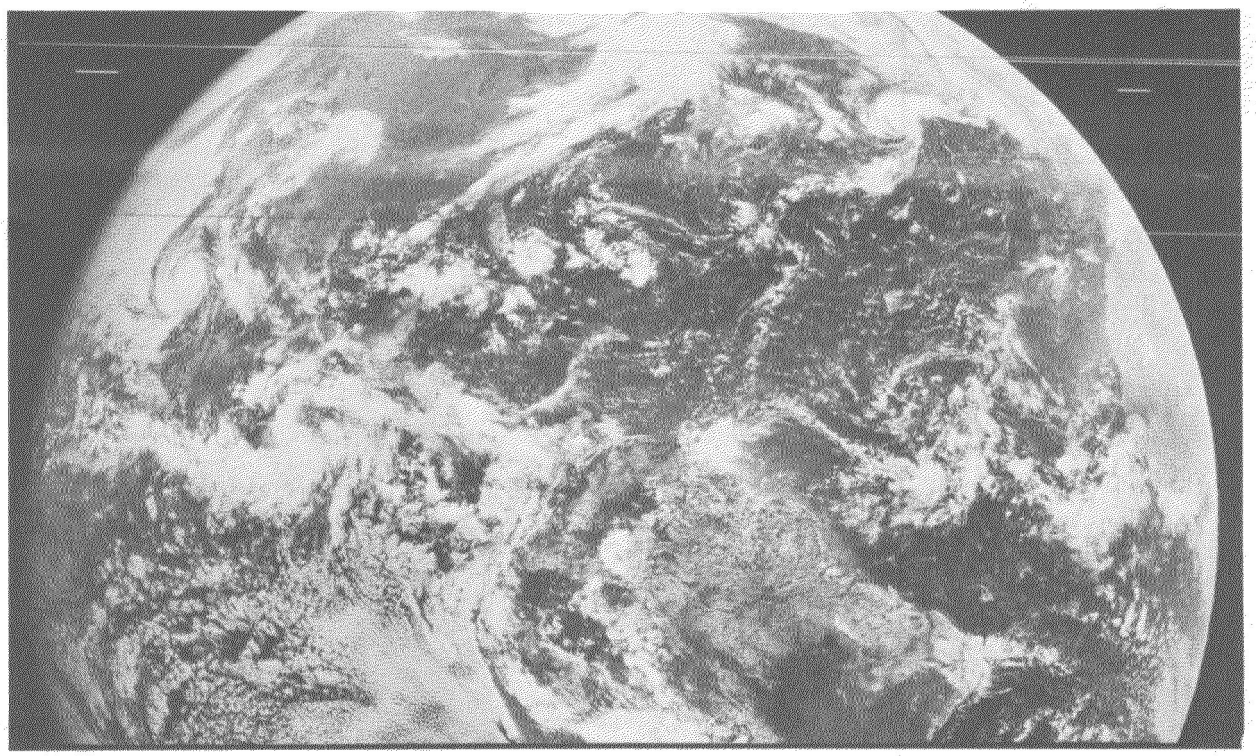

FIGURE 8.—ATS 3 photograph on Aug. 26, 1972, showing hurricane Gwen at maximum intensity. Reconnaissance aircraft reported 125-kt winds near the center of the storm.

tropical storm and moved west-northwest. Ships reported 35-kt winds 150 n.mi. to the northeast and 30-kt winds 100 n.mi. north of the center at 0000 GMT on the 30th.

A reconnaissance flight observed the storm at 1800 GMT on the 30th, finding a central pressure of 984 mb and estimating winds of 80 kt near the center. The hurricane was moving west-northwest at 12 kt. On the 31st, the reconnaissance aircraft found a central pressure of 972 mb and estimated winds of 110 kt. No flight was made on the 1st; on the 2d, the lowest pressure of 962 mb was found near 19°N, 120°W. Such a central pressure could easily have developed winds in excess of 100 kt.

The storm was weakening on the 3d (fig. 9). At 1800 GMT, the air reconnaissance observer estimated winds of 70 kt, and at 0000 on the 4th it was downgraded to tropical storm intensity. The storm continued to weaken as it passed over cooler water and took a more northerly and northeasterly course, reaching its westernmost point on the 4th near 27°N, 125°W. Thirty-kt winds were reported by ships 60 n.mi. northwest and west of the center and 100 n.mi. southwest of the center late on the 4th. Further weakening continued as the storm reached the coast. It went inland between San Diego and Los Angeles, Calif., with only 20-kt winds.

Tropical Storm Iva, September 13–22

Several areas of squalls and thunderstorms active between 5°N and the Mexican coast westward to 100°W on September 11 slowly organized into a tropical disturbance about 300 n. mi. south of Salina Cruz, Mexico. On the 12th the disturbance moved to near 12°N, 94°W. A 250-n.mi. diameter cloud showed on satellite pictures on the 13th with the center located about 300 n.mi. south of Acapulco. The *Aristocratis* reported 25-kt winds and occasional heavy rain 150 n.mi. northeast of the depression. A northwestward movement of 12 kt was measured on the 14th, but on the 15th the system slowed and intensified; it became a tropical storm near 16°N, 108°W at 1800 GMT.

The tropical storm continued moving northwest but covered a distance of only 120 n.mi. in 60 hr between 0000 GMT on the 16th and 1200 GMT on the 18th. During this period, maximum winds of 45 kt were estimated.

After 0000 GMT on the 19th, the storm curved westward and weakened. By 1800 GMT, it had weakened to depression stage, moving westward in the trade winds. It was still visible in satellite pictures for several days, but ship reports indicated no abnormal winds or seas near the cloud mass after 1800 GMT on the 22d.

Hurricane Joanne, September 30–October 6

Hurricane Joanne started as a tropical disturbance 250 n.mi. south of the Guatemala coast on September 26 with satellite pictures and ship reports indicating squally weather. The disturbance moved westward at about 15 kt on the 27th and 28th to 11°N, 99°W as it slowly developed a homogeneous cloud pattern. By the 29th, a closed circulation had developed near 12°N, 104°W with 30-kt squally weather reported by a ship about 100 n.mi. northeast of the center. Squalls extended to the coast in the northeast quadrant.

Further development continued in the following 24 hr. The *Viet Thong Tin I* reported 40-kt winds about 60 n.mi. from the center, which was located near 13°N, 106°W

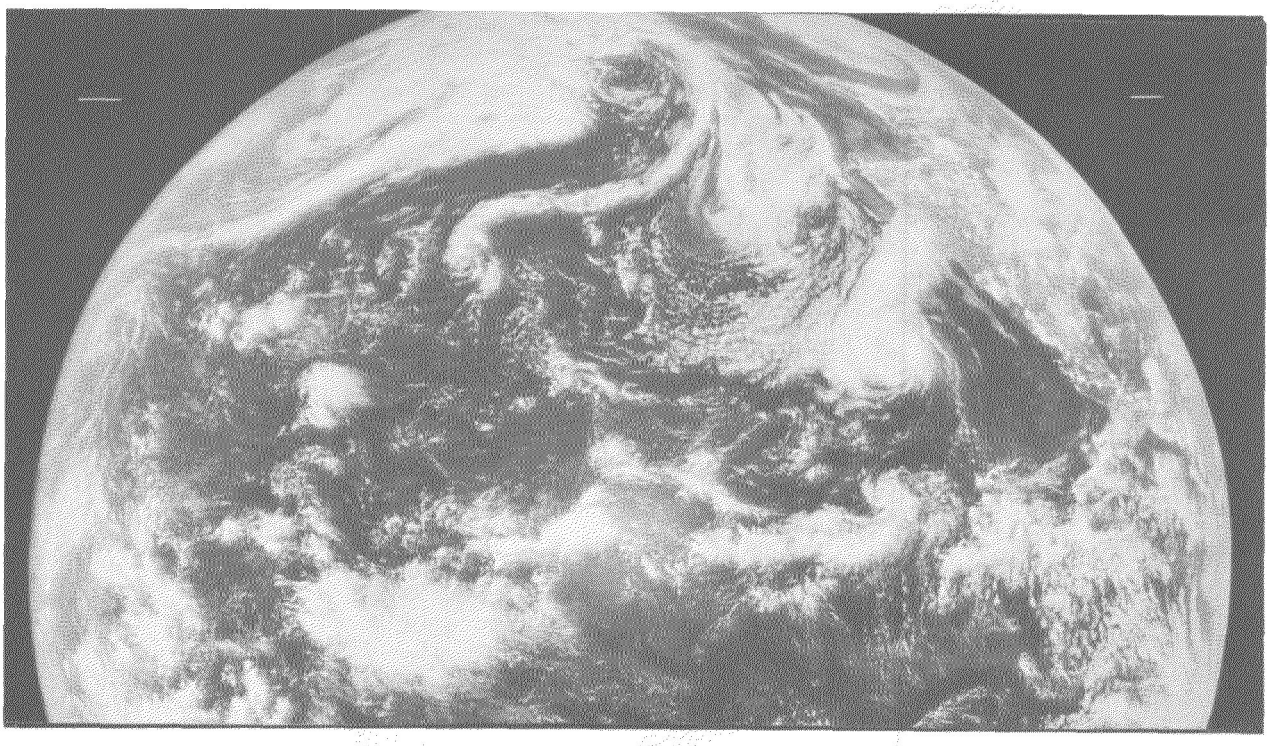

FIGURE 9.—ATS 1 photograph on Sept. 3, 1972, showing hurricane Hyacinth curving northward and weakening as it passes over cooler water.

early on the 30th. Joanne moved west-northwest at about 10 kt., developing hurricane intensity on Oct. 1 (fig. 10) with winds estimated at 65 kt by Air Force reconnaissance near 15°N, 113°W. Several ships were on the periphery of the storm, but none reported winds greater than 25 kt.

The storm moved in a more northerly direction after the 1st, and many ships 200–500 n.mi. from the center, excellent satellite pictures, and daily Air Force reconnaissance flights provided data for accurately tracking its progress. Fishing vessels near 10°N between 121° and 127°W were caught in heavy 50–60-kt weather under a band of clouds that fed moisture to the hurricane to the east-northeast.

Joanne continued in a northwestward direction between the 2d and 3d and began recurving after the center reached 22°N, 117°W on the 4th. Several ships were located between 100 and 500 n.mi. from the center, but none reported more than 30-kt winds at a time when the maximum near the center was estimated at 80 kt.

The hurricane weakened to a tropical storm during the night of the 4th near 25°N, 116°W, still with 60- and 50-kt winds reported by the *Varicella*, 75 n.mi. northeast of the center. Joanne crossed into Sebastian Vizcaino Bay late on the 5th with numerous ships reporting 30- to 55-kt winds. The *Polaris Seal*, anchored off the west side of Cedros Island, reported a pressure of 982 mb and winds of 60 kt, and a second ship near the storm center reported 60-kt winds and very rough seas during the night of the 5th.

The storm crossed Baja California during the night of the 5th. Puerto Peñasco, Mexico, winds reached 45 kt early on the 6th and by that night a 1004-mb Low was centered over Sonora, Mexico, and Pacific winds returned to normal.

Tropical Storm Kathleen, October 17–19

Tropical storm Kathleen was tracked using satellite pictures—there were no reporting ships within its area of influence. The storm was one of a number of vortexes that developed along the ITCZ early in October. It was followed as a disturbance from 10°N, 95°W on the 15th to a depression stage 300 n.mi. southwest of Manzanillo on the 18th. It became a tropical storm 420 n.mi. south of Cape San Lucas, but lasted only a matter of hours. Morning satellite pictures classed the system as a storm (fig. 11), but afternoon pictures did not. The disturbance curved northward during the night of the 18th, then northeastward on the 19th, dissipating about 175 n.mi west of Puerto Vallarta, Mexico.

Tropical Storm Liza, November 13–16

Tropical storm Liza, the last storm of the year, developed to depression stage near 11°N, 97°W on November 13. Early on the 14th, the *Benstac* reported a pressure of 1007.2 mb near the storm. Liza moved westward at about 8 kt and intensified, reaching tropical storm stage late on the 14th near 11°N, 99°W. Maximum winds were estimated at 50 kt from satellite pictures.

The storm continued westward through the night and weakened. Air Force reconnaissance at noon on the 15th indicated only an area of cloudiness with no cyclonic circulation at the surface. Liza, then classified as an easterly wave, dissipated early on the 16th.

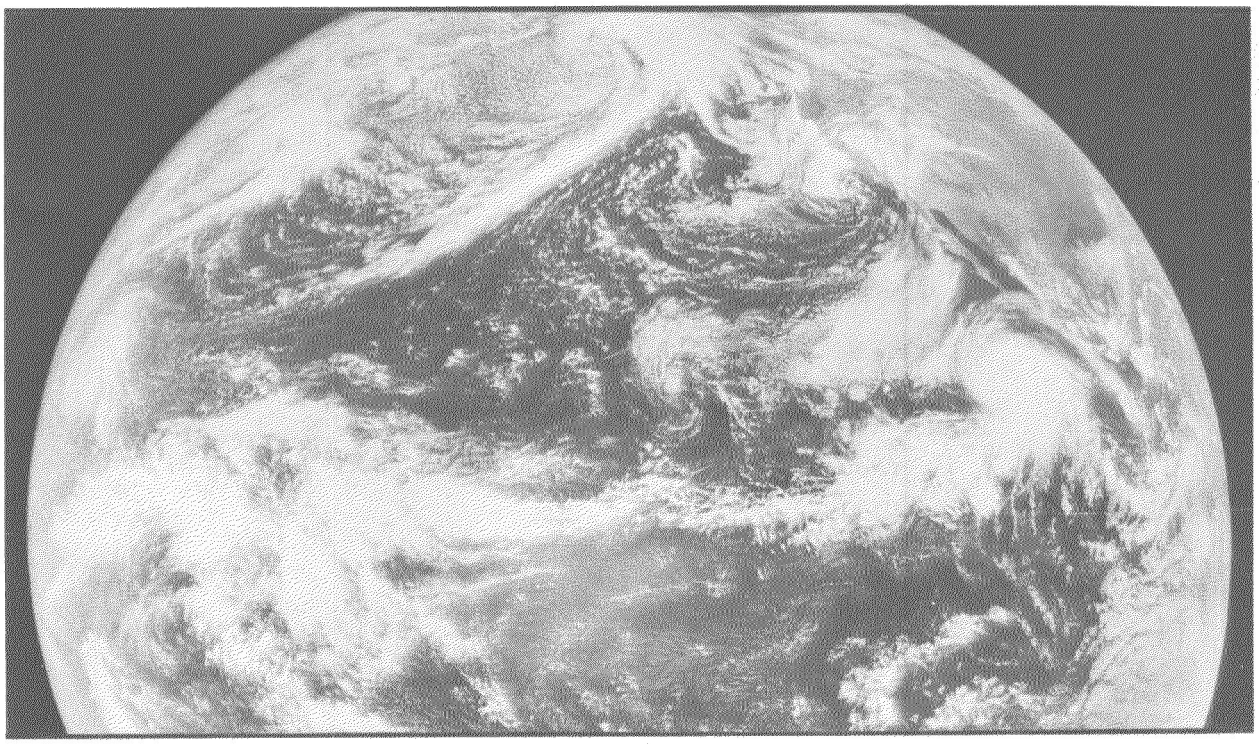

FIGURE 10.—ATS 1 photograph on Oct. 1, 1972, showing Joanne near 15°N, 113°W as she gains hurricane intensity.

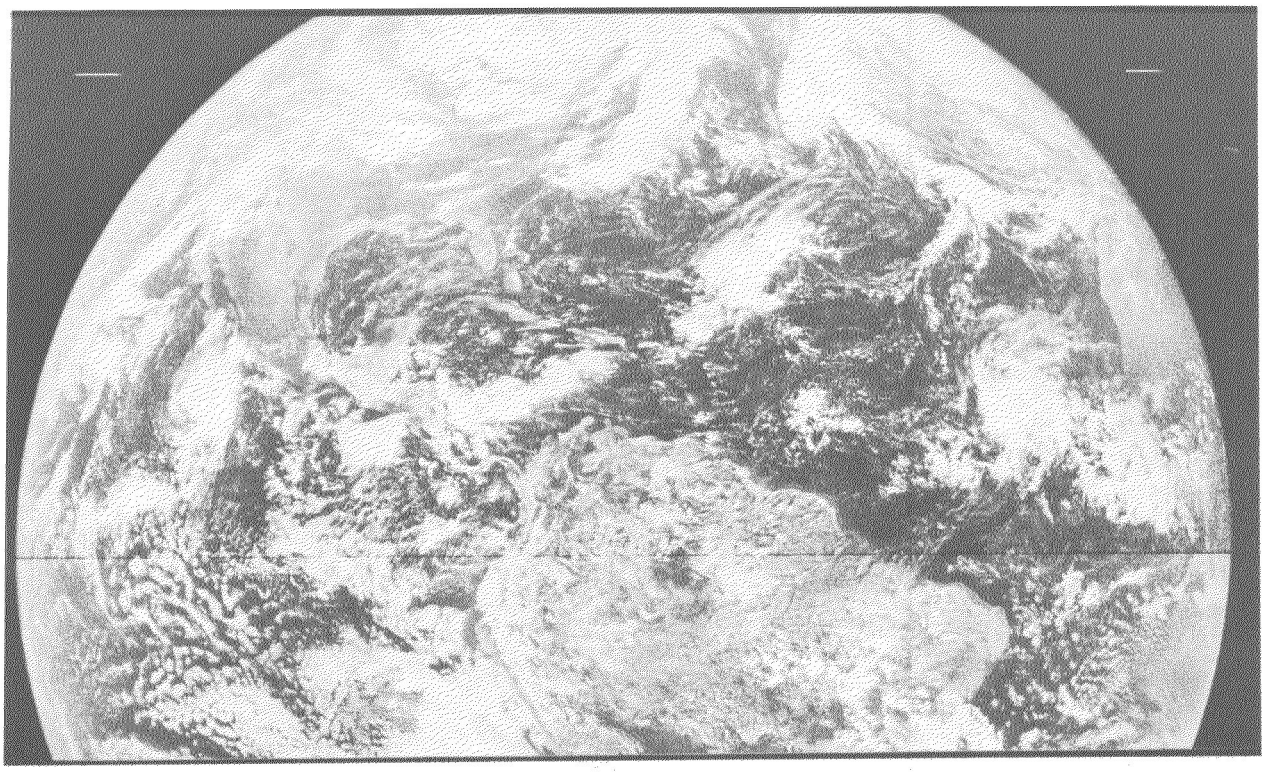

FIGURE 11.—ATS 3 photograph on Oct. 17, 1972, showing tropical storm Kathleen at near peak intensity. ATS 1 photographs 7 hr later indicated weakening to the tropical depression stage.

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